User´s Manual

ROTA***METER*** RAGN
Glass Variable Area Flowmeter

IM 01R01B10-00E-E

vigilantplant.™

YOKOGAWA

Rota Yokogawa GmbH & Co. KG
Rheinstr. 8
D-79664 Wehr
Germany

IM 01R01B10-00E-E

5th edition: July 2024 (RYG

Contents

1. Introduction

Before use, read this manual thoroughly and familiarize yourself fully with the features, operations and handling of Rotameter RAGN to have the instrument deliver its full capabilities and to ensure its efficient and correct use.

Notices Regarding This Manual

- This manual should be passed to the end user.
- The contents of this manual are subject to change without prior notice.
- All rights reserved. No part of this document may be reproduced or transmitted in any form or by any means without the written permission of Rota Yokogawa (hereinafter simply referred to as Yokogawa).
- This manual neither does warrant the marketability of this instrument nor it does warrant that the instrument will suit a particular purpose of the user.
- Every effort has been made to ensure accuracy in the contents of this manual. However, should any questions arise or errors come to your attention, please contact your nearest Yokogawa sales office that appears on the back of this manual or the sales representative from which you purchased the product.
- This manual is not intended for models with custom specifications.
- Revisions may not always be made in this manual in conjunction with changes in specifications, constructions and/or components if such changes are not deemed to interfere with the instrument's functionality or performance.

Notices Regarding Safety and Modification

- For the protection and safety of personnel, the instrument and the system comprising the instrument, be sure to follow the instructions on safety described in this manual when handling the product. If you handle the instrument in a manner contrary to these instructions, Yokogawa does not guarantee safety.
- If this instrument is used in a manner not specified in this manual, the protection provided by this instrument may be impaired.
- As for explosion proof model, if you yourself repair or modify the instrument and then fail to return it to its original form, the explosion protected construction of the instrument will be impaired, creating a hazardous condition. Be sure to consult Yokogawa for repairs and modifications.

The following safety symbols and cautionary notes are used on the product and in this manual:

WARNING

This symbol is used to indicate that a hazardous condition will result which, if not avoided, may lead to loss of life or serious injury. This manual describes how the operator should exercise care to avoid such a risk..

CAUTION

This symbol is used to indicate that a hazardous condition will result which, if not avoided, may lead to minor injury or material damage. This manual describes how the operator should exercise care to avoid a risk of bodily injury or damage to the instrument.

IMPORTANT

This symbol is used to call your attention to a condition that must be observed in order to avoid the risk of damage to the instrument or system problems.

NOTE

This symbol is used to call your attention to information that should be referred to in order to know the operations and functions of the instrument.

For Safe Use of Rotameter RAGN

WARNING

- If the process fluid is harmful to personnel, handle Rotameter RAGN carefully even after it has been removed from the process line for maintenance or other purposes. Exercise extreme care to prevent the fluid from coming into contact with human flesh and to avoid inhaling any residual gas.
- In case of Explosion proof type instrument, further requirements and differences are described in Chapter 6 "EXPLOSION PROTECTED TYPE INSTRUMENTS". The description in Chapter 6 is prior to other descriptions in this instruction manual.

Warranty

- The warranty of this instrument shall cover the period noted on the quotation presented to the Purchaser at the time of purchase. The Seller shall repair the instrument free of charge when the failure occurred during the warranty period.
- All inquiries on instrument failure should be directed to the Seller's sales representative from whom you purchased the instrument or your nearest sales office of the Seller.
- Should the instrument fail, contact the Seller specifying the model and instrument number of the product in question. Be specific in describing details on the failure and the process in which the failure occurred. It will be helpful if schematic diagrams and/or records of data are attached to the failed instrument.
- Whether or not the failed instrument should be repaired free of charge shall be left solely to the discretion of the Seller as a result of an inspection by the Seller.

The Purchaser shall not be entitled to receive repair services from the Seller free of charge, even during the warranty period, if the malfunction or damage is due to:

- improper and/or inadequate maintenance of the instrument in question by the Purchaser.
- handling, use or storage of the instrument in question beyond the design and/or specifications requirements.
- use of the instrument in question in a location not conforming to the conditions specified in the Seller's General Specification or Instruction Manual.
- retrofitting and/or repair by an other party than the Seller or a party to whom the Seller has entrusted repair services.
- improper relocation of the instrument in question after delivery.
- reason of force measure such as fires, earthquakes, storms/ floods, thunder/lightning, or other reasons not attributable to the instrument in question.
- YOKOGAWA gives no warranty for the improper use of glass flow meters.

WARNING

- When removing the instrument from hazardous processes, avoid contact with the fluid and the interior of the meter.
- In case of Explosion proof type instrument, further requirements and differences are described in Chapter 6 " EXPLOSION PROTECTED TYPE INSTRUMENTS". The description in Chapter 6 is prior to other descriptions in this instruction manual.

Notices regarding EMC

The Rotameter RAGN with option /GR2 – /GR8 is conform to the European EMC Guideline and fulfills the following standards:
DIN EN 61000-4-2: level 3
DIN EN 61000-4-3: level 2
DIN EN 61000-4-4: level 3
DIN EN 61000-4-6: level 2
DIN EN 55011: group 1 / class A
The RAGN with option /GR2 – /GR8 is a class A product and should be used and installed properly according to the EMC Class A requirements.

IMPORTANT

Although the inductive ring sensor has been designed to resist high frequency electrical noise, if a radio transceiver is used near the transmitter or it external wiring, the transmitter may be affected by high frequency noise pickup. To test for such effects, bring the transceiver in use slowly from a distance of several meters from the transmitter, and observe the measurement loop for noise effects. Thereafter, always use the transceiver outside the area affected by noise.

1.1 ATEX Documentation

This is only applicable to the countries in European Union.

GB

All instruction manuals for ATEX Ex related products are available in English, German and French. Should you require Ex related instructions in your local language, you are to contact your nearest Yokogawa office or representative.

DK

Alle brugervejledninger for produkter relateret til ATEX Ex er tilgængelige på engelsk, tysk og fransk. Skulle De ønske yderligere oplysninger om håndtering af Ex produkter på eget sprog, kan De rette henvendelse herom til den nærmeste Yokogawa afdeling eller forhandler.

I

Tutti i manuali operativi di prodotti ATEX contrassegnati con Ex sono disponibili in inglese, tedesco e francese. Se si desidera ricevere i manuali operativi di prodotti Ex in lingua locale, mettersi in contatto con l'ufficio Yokogawa più vicino o con un rappresentante.

E

Todos los manuales de instrucciones para los productos antiexplosivos de ATEX están disponibles en inglés, alemán y francés. Si desea solicitar las instrucciones de estos artículos antiexplosivos en su idioma local, deberá ponerse en contacto con la oficina o el representante de Yokogawa más cercano.

NL

Alle handleidingen voor producten die te maken hebben met ATEX explosiebeveiliging (Ex) zijn verkrijgbaar in het Engels, Duits en Frans. Neem, indien u aanwijzingen op het gebied van explosiebeveiliging nodig hebt in uw eigen taal, contact op met de dichtstbijzijnde vestiging van Yokogawa of met een vertegenwoordiger.

SF

Kaikkien ATEX Ex -tyyppisten tuotteiden käyttöhjeet ovat saatavilla englannin-, saksan- ja ranskankielisinä. Mikäli tarvitsette Ex -tyyppisten tuotteiden ohjeita omalla paikallisella kielellännne, ottakaa yhteyttä lähimpään Yokogawa-toimistoon tai -edustajaan.

P

Todos os manuais de instruções referentes aos produtos Ex da ATEX estão disponíveis em Inglês, Alemão e Francês. Se necessitar de instruções na sua língua relacionadas com produtos Ex, deverá entrar em contacto com a delegação mais próxima ou com um representante da Yokogawa.

F

Tous les manuels d'instruction des produits ATEX Ex sont disponibles en langue anglaise, allemande et française. Si vous nécessitez des instructions relatives aux produits Ex dans votre langue, veuillez bien contacter votre représentant Yokogawa le plus proche.

D

Alle Betriebsanleitungen für ATEX Ex bezogene Produkte stehen in den Sprachen Englisch, Deutsch und Französisch zur Verfügung. Sollten Sie die Betriebsanleitungen für Ex-Produkte in Ihrer Landessprache benötigen, setzen Sie sich bitte mit Ihrem örtlichen Yokogawa-Vertreter in Verbindung.

S

Alla instruktionsböcker för ATEX Ex (explosionssäkra) produkter är tillgängliga på engelska, tyska och franska. Om Ni behöver instruktioner för dessa explosionssäkra produkter på annat språk, skall Ni kontakta närmaste Yokogawakontor eller representant.

GR

Όλα τα εγχειρίδια λειτουργίας των προϊόντων με ATEX Ex διατίθενται στα Αγγλικά, Γερμανικά και Γαλλικά. Σε περίπτωση που χρειάζεστε οδηγίες σχετικά με Ex στην τοπική γλώσσα παρακαλούμε επικοινωνήστε με το πλησιέστερο γραφείο της Yokogawa ή αντιπρόσωπο της.

SK

Všetky návody na obsluhu pre prístroje s ATEX Ex sú k dispozícii v jazyku anglickom, nemeckom a francúzskom. V prípade potreby návodu pre Ex-prístroje vo Vašom národnom jazyku, skontaktujte prosím miestnu kanceláriu firmy Yokogawa.

CZ

Všechny uživatelské příručky pro výrobky, na něž se vztahuje nevýbušné schválení ATEX Ex, jsou dostupné v angličtině, němčině a francouzštině. Požadujete-li pokyny týkající se výrobků s nevýbušným schválením ve vašem lokálním jazyku, kontaktujte prosím vaši nejbližší reprezentační kancelář Yokogawa.

LT

Visos gaminiø ATEX Ex kategorijos Eksploatavimo instrukcijos teikiami anglø, vokieèiø ir prancûzø kalbomis. Norëdami gauti prietaisø Ex dokumentacijà kitomis kalbomis susisiekite su artimiausiu bendrovës "Yokogawa" biuru arba atstovu.

LV

Visas ATEX Ex kategorijas izstrâdâjumu Lietoðanas instrukcijas tiek piegâdâtas angïu, vâcu un franèu valodâs. Ja vçlaties saòemt Ex ierîèu dokumentâciju citâ valodâ, Jums ir jâsazinâs ar firmas Jokogava (Yokogawa) tuvâko ofisu vai pârstâvi.

EST

Kõik ATEX Ex toodete kasutamisjuhendid on esitatud inglise, saksa ja prantsuse keeles. Ex seadmete muukeelse dokumentatsiooni saamiseks pöörduge lähima lokagava (Yokogawa) kontori või esindaja poole.

PL

Wszystkie instrukcje obsługi dla urządzeń w wykonaniu przeciwwybuchowym Ex, zgodnych z wymaganiami ATEX, dostępne są w języku angielskim, niemieckim i francuskim. Jeżeli wymagana jest instrukcja obsługi w Państwa lokalnym ję zyku, prosimy o kontakt z najbliższym biurem Yokogawy.

SLO

Vsi predpisi in navodila za ATEX Ex sorodni pridelki so pri roki v angliščini, nemščini ter francoščini. Èe so Ex sorodna navodila potrebna v vašem tukejnjem jeziku, kontaktirajte vaš najbliši Yokogawa office ili predstaunika.

H

Az ATEX Ex mûszerek gépkönyveit angol, német és francia nyelven adjuk ki. Amennyiben helyi nyelven kérik az Ex eszközök leírásait, kérjük keressék fel a legközelebbi Yokogawa irodát, vagy képviseletet.

BG

Всички упътвания за продукти от серията ATEX Ex се предлагат на английски, немски и френски език. Ако се нуждаете от упътвания за продукти от серията Ex на родния ви език, се свържете с най-близкия офис или представителство на фирма Yokogawa.

RO

Toate manualele de instructiuni pentru produsele ATEX Ex sunt in limba engleza, germana si franceza. In cazul in care doriti instructiunile in limba locala, trebuie sa contactati cel mai apropiat birou sau reprezentant Yokogawa.

M

Il-manwali kollha ta' l-istruzzjonijiet għal prodotti marbuta ma' ATEX Ex huma disponibbli bl-Ingliż, bil-Ġermaniż u bil-Franċiż. Jekk tkun teħtieġ struzzjonijiet marbuta ma' Ex fil-lingwa lokali tiegħek, għandek tikkuntattja lill-eqreb rappreżentan jew uffiċċju ta' Yokogawa.

1.2 General description

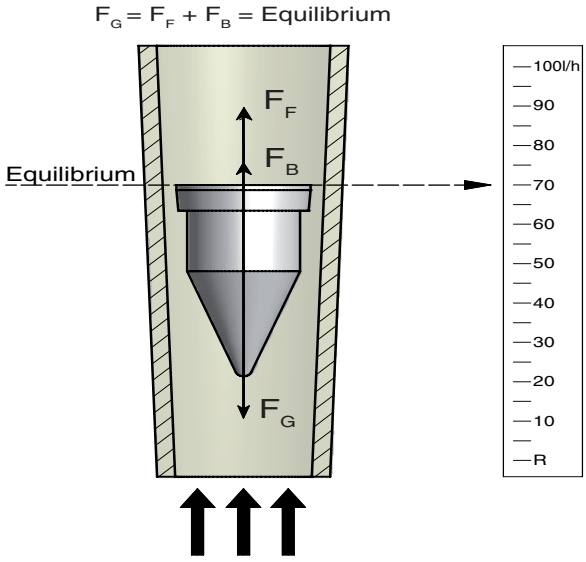
This manual describes installation, operation and maintenance of the RAGN. Please read it carefully before using this device.
Further, please note that customer features are not described in this manual. When modifying specifications, construction or parts, this manual is not necessarily revised unless it can be assumed that these changes will impair RAGN functions or performance.
All units are thoroughly tested before shipping. Please check the received units visually to ensure that they have not been damaged during transport. In case of defects or questions please contact your nearest YOKOGAWA service centre or sales office. Please describe any defect precisely and indicate model code as well as serial number.
YOKOGAWA refuses any liability for units which have been repaired by the user without prior consent and do not meet the specifications as a consequence.

1.3 Principle of measurement

A Rotameter measures the flow of liquids, gases and steam by using a float inside a conical tube.
The gap between the tube and float is larger at the top to allow a greater flow to pass through the meter. As gravity works in a vertical orientation so the tube needs to be vertically oriented.
Rota Yokogawa developed the free rotating float which stabilises its position in the centre of the cone to provide a more stable flow measurement.
The medium passes through the metering tube from bottom to top and consequently rises the float until there is an annular gap between the inside surface of the metering tube and the float and equilibrium of the following forces has been achieved.

Buoyancy / Gravity / Friction force

The Rotameter principle is one of the oldest and mature principles in flow measurement. This mechanical principle is as simple as it is reliable. The flow is indicated by the top of the float and can be read from the standard scale on the metering tube. The RAGN can be equipped with limit switches option /GR2 to /GR8 and /GM1 to /GM5.
All units are calibrated with water or air by the manufacturer. By adjusting the calibration values to the measured substance's state of aggregation (density, viscosity), the flow rate scale for each measuring tube can be determined. When the process conditions have changed the scale is not accurate any longer and the glass tube needs to be replaced.



1.4 Intended use

The RAGN is designed for the continuous flow measurement of liquids or gases and can be used in all industries.
Typical applications are:
• Visual fluid monitoring
• Industrial gas measurement
• Controlling of water circuits

2. Transportation and Storage

Transportation instructions

When transporting the instrument, you must observe the following safety instructions in order to avoid injury, damage to the instrument and other material damage.
The steps involved in transport may only be carried out by qualified persons taking into account the safety instructions.

- Observe the transport instructions on the packaging.
- Observe the below mentioned storage conditions.
- Use only the original packaging.
- The packaging material must be disposed of in accordance with the regulations.
- The transport braces must not be removed until installation.
- Read the chapter “Safety instructions”.
- To avoid any damages, unpack the flow meter only at the installation site.
- Mechanical shocks are to be avoided.

Storage conditions

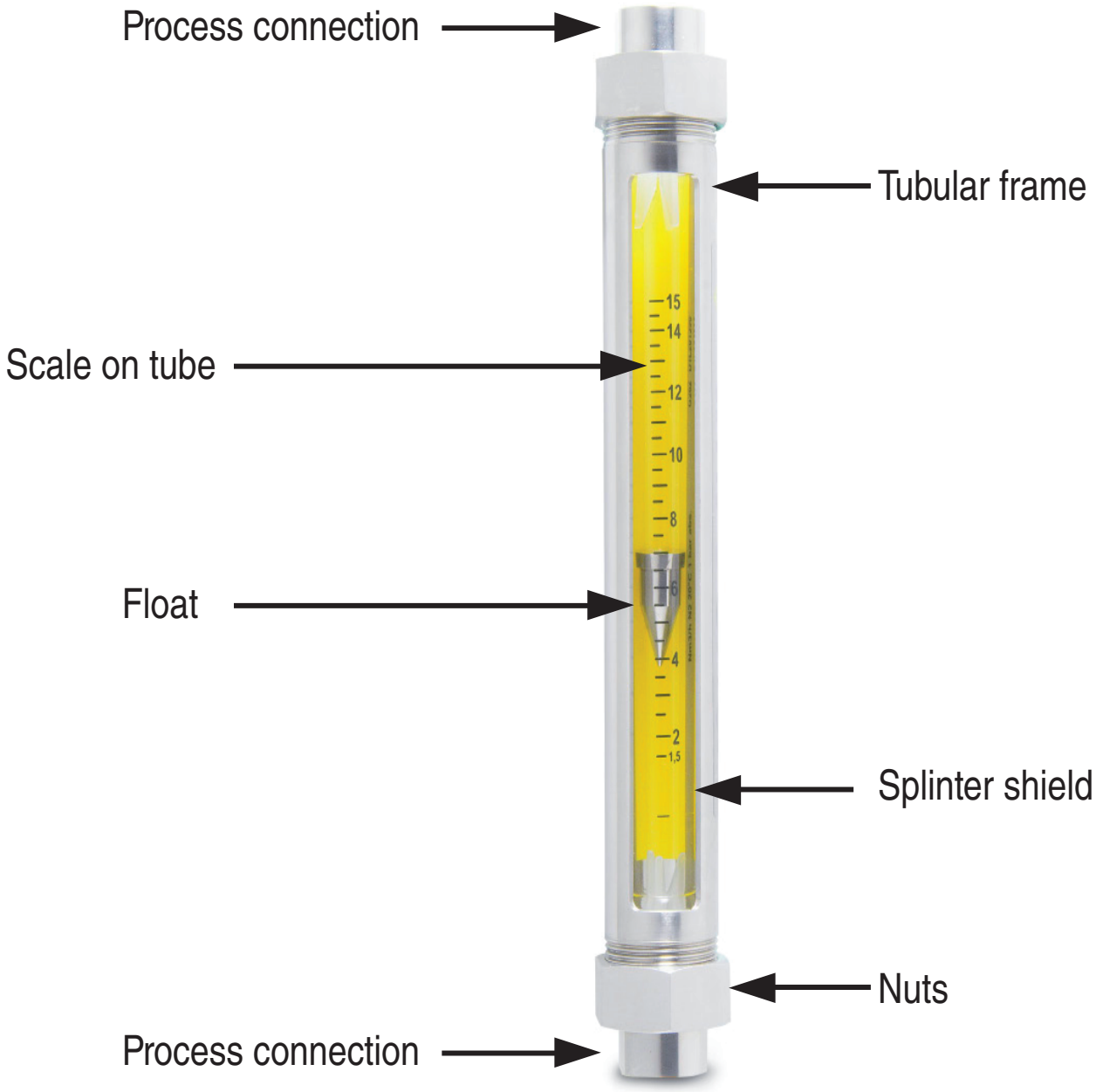
Please note the following for storage purposes:
- The instrument should be stored in its transport packaging.
- Choose a storage place that meets the following requirements:

- Protection from rain and humidity
- Free of mechanical vibration and shocks
- Ambient temperature between -25 °C – 60 °C
- Atmospheric humidity ranging from 0 – 100 %. Operation above 95 % for longer times is not recommended

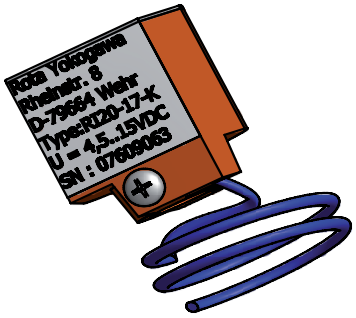
Before storing a used flow meter remove any fluid from the flow meter and clean it in order to avoid fouling. Properties of the instrument can change when stored outdoors.

3. Product description

3.1 Metering Tube



3.2 Bistable inductive ring sensor (Option /GR2 – /GR8)

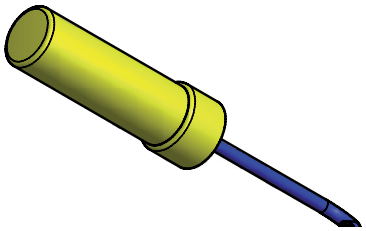


The ring sensor type RI20 is intended for connection to glass Rotameters. It indicates whether the float is positioned above or below the sensor.
The float must have ferromagnetic properties (e.g. a PVDF float with iron core).
The device is offered into 3 versions:

Type	Option	Diameter of tube	Possible float (Yokogawa Code)
RI20-10 G	/GR2, /GR6	10mm	-PD B□N
RI20-17 K	/GR3, /GR7	17mm	-PD C□N
RI20-17 G	/GR4, /GR8	17mm	-PD D□N

The RI20 is bistable, i.e. if the float is below the switch point, current consumption is always < 1 mA and it is > 2.2 mA, if the float is above the switch point. After power on or after power fail the RI20 shows I < 1 mA. To find the correct float position the float has to move once through the RI20.
It is intended for connection to a non-bistable isolation-switch amplifier complying with DIN EN 50227 (NAMUR) (e.g. options /Wxx). With its plastic housing and its sealed-in electronic equipment, the RI20 meets the requirements for protection class IP67 and can also be operated safely in aggressive atmospheres.
The RI20 is maintenance-free.
See chapter 6 "EXPLOSION PROTECTED TYPE INSTRUMENTS" for devices in ATEX version.

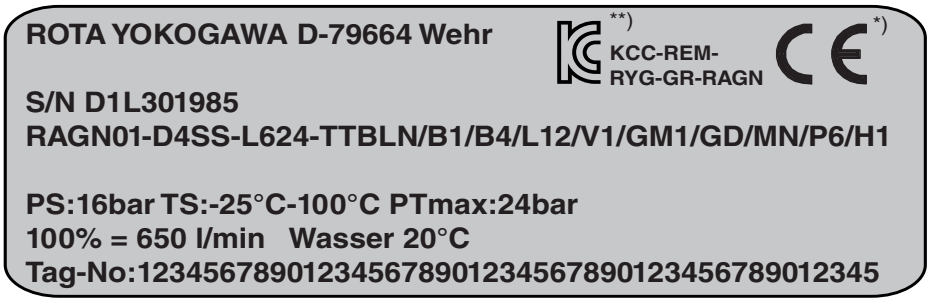
3.3 Magnetic contact (Option /GM1 – /GM5)



The limit switch is mounted to a Rotameter type RAGN, if a magnetic float is used and indicates if the flow falls below the set limit (MIN-contact) or exceeds the set limit (MAX-contact).
When reaching the switch point the Reed contact with bias by a permanent magnet opens when the float enters the alarm range. The Reed contact closes when the float leaves the alarm range. Opened or closed the Reed contact remains because of its bistability in its position no matter how far the float moves away.
Due to the low switch output of the Reed contact (max, 10 VA/(W), max. 0.5 A, max. 230 V AC) a transformer isolated barrier (e.g. option /W□□) should be connected to the GM.

3.4 Marking

Name plate of RAGN:



*) only for RAGN04, RAGN05, RAGN06 **) only with option /KC

Name plate of inductive ring sensor (option /GR2 to /GR8)

4. Installation

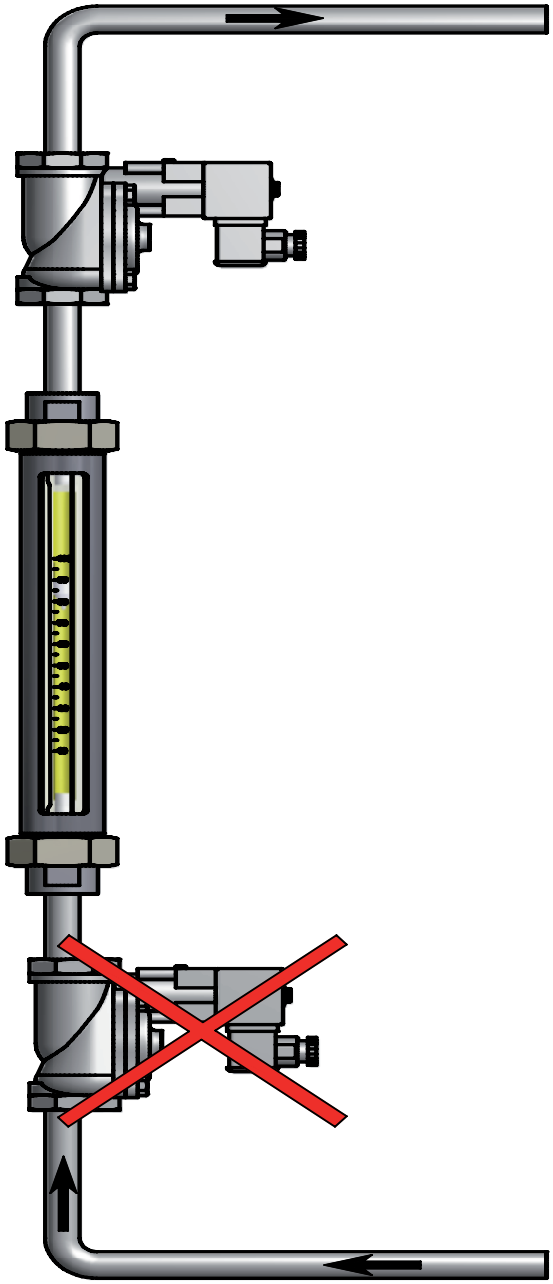
4.1 General

Installation:
All packaging material must be removed. The transportation lock for the float must be removed.
The piping shall be flushed before installing the flowmeter. Piping must be dried for gas applications. Rotameters must be installed vertically. The flow direction is from bottom to top. Prevent the device from mechanical stress and vibration by aligning and supporting the piping. Avoid large volumes of gas downstream and upstream of the device, this can cause vibration due to compression. Install the On/Off valve downstream in order to avoid damage when opening the valve. In case of gas applications, increase the flow pressure slowly. Avoid pressure surges and temperature shocks to the flowmeter at any time.
Refer to the pressure and temperature limits of the device. For flowmeters with limit switches please see chapter 4.3, 4.4 and 4.5.
Further installation hints can be found in VDI/VDE 3513 sheet 3.

Commissioning:
When functioning properly, the float moves freely in the flow. With floats with notches this can be easily seen by their rotation. If the float does not move, please check the installation.
The flow rate can be read directly from the scale on the tube. Refer to the scale mark to which the float adjusts its top edge when reading.

Maintenance:
With common applications and normal operating conditions the device is maintenance free. In case of soiling we recommend to clean the measuring tube by using a bottle brush and soap water. Make sure not to scratch the measuring tube. If float or measuring tube show signs of wear and tear, we recommend replacing them.

4.2 Piping



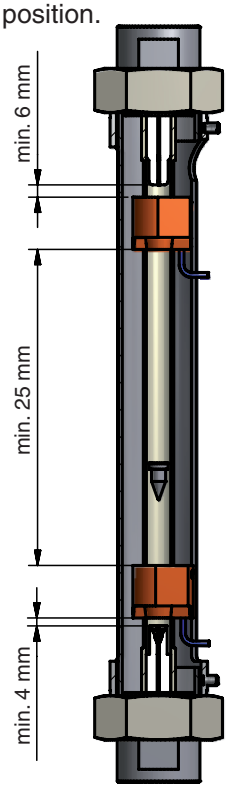
IMPORTANT

On/Off- valve must be installed downstream!

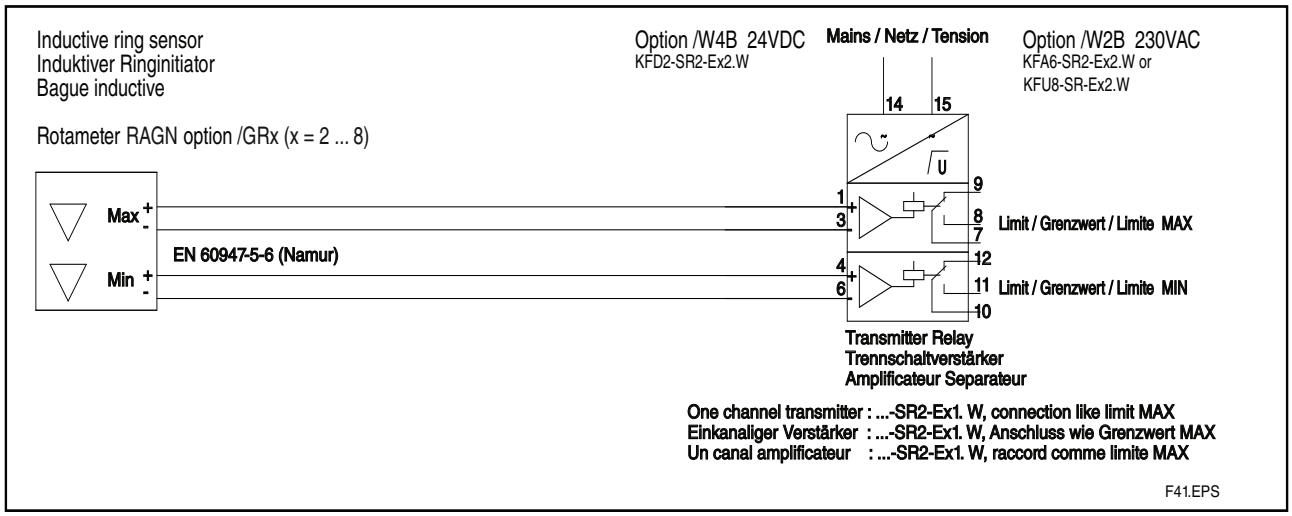
4.3 Bistable inductive ring sensor (Option /GR2 – /GR8)

- The ring sensor should be connected to a mono stable transmitter relay.
- Connection to transmitter relay (s. installation diagram below)

  white cable → +
  shielding → –
- The installation regulations in accordance with IEC 364 have to be taken into account.
- The shielding of the connection cable is not for earthing of the ring sensor. A ring sensor with a damaged cable insulation may not be used
- The device has to be protected from strong electromagnetic fields.
- Power lines have to be installed separated from the signal lines.
- Switches, power relays and engines can change the switching state of the ring sensor (in unfavorable orders).
- Metal parts should have a minimum distance of 50 mm to the ring sensor.
- If the float is above the ring sensor after power on or after power fail, the float has to move once through the ring sensor to find the correct float position.



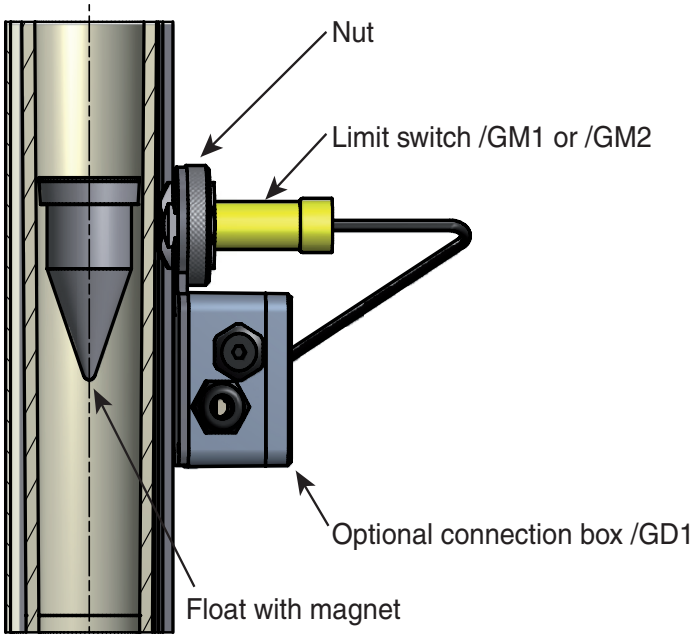
Connection to transmitter relay:



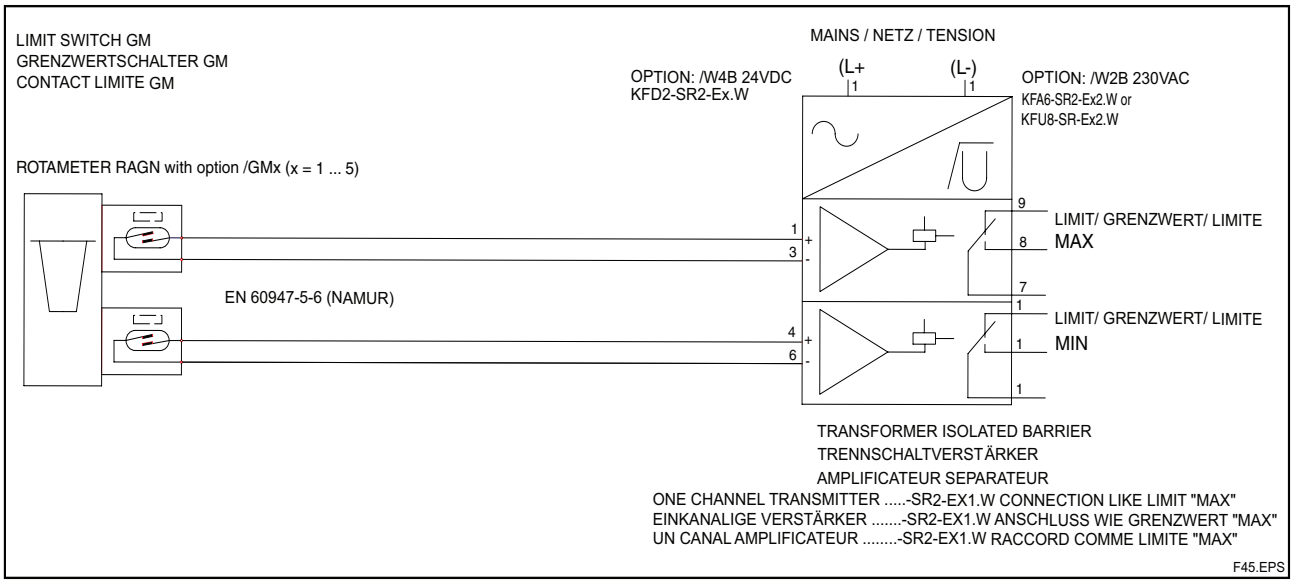
For installation in hazardous area see chapter 6 "EXPLOSION PROTECTED TYPE INSTRUMENTS".

4.4 Magnetic contact (Option /GM1 – /GM5)

a) Loose the nut at the guide sleeve.
b) If two limit switches were ordered install the Max-contact in the top position and the Min- contact in the low position (see print on housing).
c) Put the limit switch from the outer side on the guide rail of the Rotameter.
d) Adjust the distance between limit switch to tube to 1 mm; check function and correct if necessary.
e) Fix limit switch with the nut to guide rail.



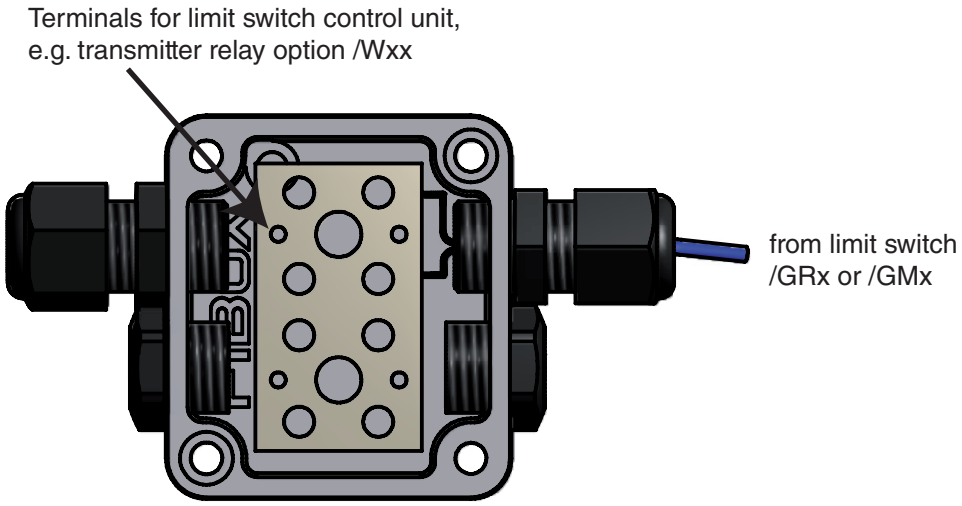
Connection to transmitter relay:



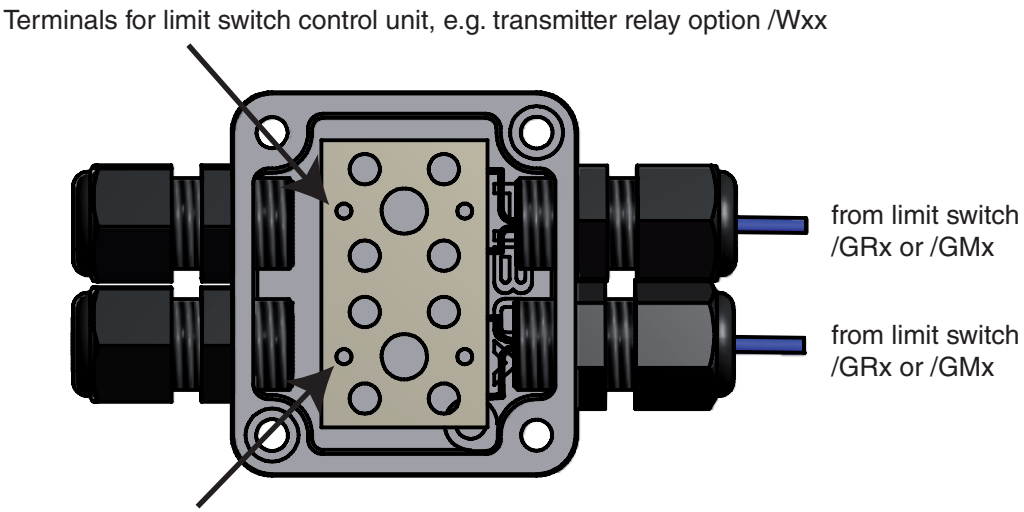
4.5 Connection box (Option /GD1 or /GD2)

For one limit switch the connection box with option /GD1 and for two limit switches the connection box with option /GD2 is available.
Please make the connections in the connection box as shown below.

Option /GD1



Option /GD2



5. Service

5.1 Dismantling and disposal

5.1.1 Decontamination and return shipment

WARNING

Use of fluids that are a health hazard may result in caustic burns or poisoning

- When removing the flow meter, avoid touching the fluid and breathing gas residues left in the sensor.
- Wear protective clothing and a breathing mask.

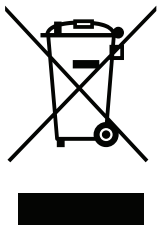
Note the following items before returning the shipment:

- Clean flow meter thoroughly. No harmful chemicals must remain in or on the flow meter.
  Rota Yokogawa only accepts completely drained and cleaned flow meters.
- The form "Decontamination Declaration" must be filled in completely and sent to Yokogawa along with the flow meter.
- Package flow meter in a shockproof manner for transport. Use original packaging, if possible.

5.1.2 Disposal

Prior to disposal of the flow meter, please take note of the following:

- Comply with the applicable national regulations in the event of disposal or recycling.
- Do not dismantle flow meter until all fluid residues have been removed and dispose the parts individually.



Devices described in this manual should be recycled. They may n
not be disposed of in the municipal waste disposal services according to the Directive 2012/19/EC on waste electronic and electrical equipment (WEEE). Devices can be returned to the supplier within the EU and UK, or to a locally approved disposal service for eco-friendly recycling.
Observe the specific regulations valid in your country.

CAUTION

Special disposal required
The device includes components that require special disposal.
Dispose of the device properly and environmentally through a local waste disposal contractor.

ROTA YOKOGAWA GmbH & Co. KG
Service & Repair Department
Rheinstraße 8; D - 79664 Wehr
Phone no.: +49 (0)7761-567-190
Fax no.: +49 (0)7761-567-285
e-Mail: YEF-RYG-Flow.Services@yokogawa.com

Declaration of Decontamination

Legal regulations for the safety of our employees and operating equipment determine that we need the declaration of decontamination before your order can be handled.
Please make sure to include it with the shipping documents, attached to the outside of the packaging you use for shipment.

Customer data		
Company:		
Address:		
Contact person:		E-Mail:
Phone no.:		Fax no.:
Reference/Order no.:		

Instrument data*	
Type:	Serial no.:
Type:	Serial no.:

*If not enough, note on separate sheet

Process data: -		
Process medium:-		
Medium is: -	[ ] toxic [ ] corrosive [ ] explosive [ ] biological hazardous [ ] unknown if dangerous [ ] non hazardous	Remarks:
Cleaning agent:-		
Kind of cleaning :-		

Other remarks / Reason of return:

We hereby confirm that this statement is filled in completely and truthfully. The returned instruments were carefully cleaned and are thus free from product residue and dirt. I agree that if this arrangement does not match with the instruments, they will be sent back to the above mentioned customer address at our expenses.

Name Date Signature

6. Explosion protected type instruments

6.1 Bistable inductive ring sensor (Option /GR2 – /GR8)

WARNING

- Only trained persons may use the instrument in the industrial area.
- It is forbidden to users to carry out specification changes and other changes at the device. Repairs at the device aren't permitted.
- To ensure explosion protection of the RI20, a suitable explosion-proof transmitter relay must be used.
- The maximum ambient temperature and the maximum temperature of the medium, which flows through the tube, may not exceed 60 °C.
- The connection cable may not be exposed to mechanical loads. The maximum axial strength is 30 N.

6.1.1 ATEX (option /KS1)

The inductive ring sensor RI20 is an intrinsic safe device. This is certified for hazardous areas of zone 1 (category 2) and zone 2 (category 3). They are not homologated for zone 0 (category 1). The classifications in brackets are given according to EU- Directive 2014/34/EU (ATEX).
Temperature range: -25 °C – +60 °C
EC- Type Examination Certificate number: PTB 03 ATEX 2111X

The identification in accordance with regulation Directive 2014/34/EU (ATEX)

- Manufacturer : Rota Yokogawa, Rheinstr. 8, D-79664 Wehr
- Type : RI20-10 or RI20-17
- Serial number and year of the production:
  7yymmxxx (yy=year, mm=month, xxx= incremented number (e.g. 70309001)
- Protection : Ex ia
- Group : IIC
- Category : 2
- Explosive atmosphere : G
- Temperature class : T6
- Certificate No. : PTB 03 ATEX 2111X
- Entity parameters : Ui = 12 V, Ii = 22 mA , Pi = 66 mW,
  Li = 20 mH, Ci = 200 nF
  or
  see certificate for data
- Marking according to Directive 2014/34/EU: CE 0344 Ex II 2 G

WARNING

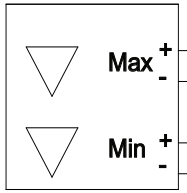
- The electrical connection of the RI20 is provided with free ends of the cables with cable hulls. Please regard the installation regulations in accordance with IEC 364.
- The shielding of the connection cable is not for grounding of the RI20. A RI20 with damaged cable isolation may not be used.
- Static charges of the RI20 housing have to be avoided. A corresponding warning note has to be attached at the device.

Hazardous Area
Ex- Bereich
Zone Ex

Safe Area
Sicherer Bereich
Hors Zone

Inductive ring sensor RI20
Induktiver Ringinitiator RI20
Bague inductive RI20

Rotameter RAGN option /GRx (x = 2 ... 8)

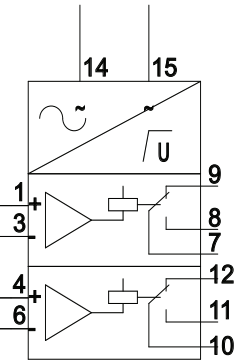


EN 60947-5-6 (Namur)

Option /W4B 24VDC
KFD2-SR2-Ex2.W

Mains / Netz / Tension

Option /W2B 230VAC
KFA6-SR2-Ex2.W or
KFU8-SR-Ex2.W



Transmitter Relay
Trennschaltverstärker
Amplificateur Separateur

Maximum medium- and ambient temperature :
Maximale Mediums- und Umgebungstemperatur :
Temperature ambiante et temperature de fluide maximale :

Tamax = 60°C

One channel transmitter : ...-SR2-Ex1.W, connection like limit MAX
Einkanaliger Verstärker : ...-SR2-Ex1.W, Anschluss wie Grenzwert MAX
Un canal amplificateur : ...-SR2-Ex1.W, raccord comme limite MAX

RI20-10, RI20-17
Ex ia IIC T6
Ui = 12V
Ii = 22mA
Pi = 66mW
Ci = 200nF
Li = 20mH

PTB 03 ATEX 2111X
IECEx PTB.13.0023X

KFD2-SR2-Ex2.W [Ex ia] IIC
U_O = 10.5V
I_O = 13mA
P_O = 34mW
C_O = 2410nF
L_O = 210mH

PTB 00ATEX 2080
IECEx PTB.11.0034

KFA6-SR2-Ex2.W [Ex ia Ga] IIC
U_O = 10.6 V
I_O = 19.1 mA
P_O = 51 mW
C_O = 2320 nF
L_O = 97 mH

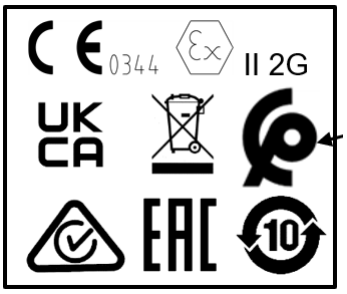
PTB 00ATEX2081
IECEx PTB 11.0031

KFU8-SR-Ex2.W [Ex ia Ga] IIC
U_O = 10.5 V
I_O = 13 mA
P_O = 34mW
C_O = 2410 nF
L_O = 210 mH

FIDI 22 ATEX 0029X
IECEx FIDI 22.0003X

Marking:

Rota Yokogawa	Ex ia IIC T6 Gb
GmbH & Co.KG	PTB 03ATEX2111X
Rheinstrs. 8	IECEx PTB13.0023X
D-79664 Wehr	CML 21UKEX21276X
Type ...	See certificate for data
U = 4.5...15VDC	POTENTIALELECTROSTATIC
SN:	CHARGING HAZARD



6.1.2 IECEx (option /ES1)

Certificate number:
IECEx PTB13.0023X
Data, installation an marking see ATEX chapter 6.1.1.

6.1.3 Intrinsically safe RAGN with option /GR2 – /GR8 with Taiwan Safety Label (option /ES1)

Registration Document:
ML0412007043A3
Same data as IECEx-certifiied type (/ES1)
For export to Taiwan please contact your Yokogawa representative regarding Taiwan Safety Label.

6.1.4 Intrinsically safe ECAS (UAE) (option /ES1)

Certificate number:
24-05-111620/E24-05-115195/NB0010
Data, installation an marking see IECEx chapter 6.1.2.

6.2 Magnetic contact (Option /GM1 – /GM5)

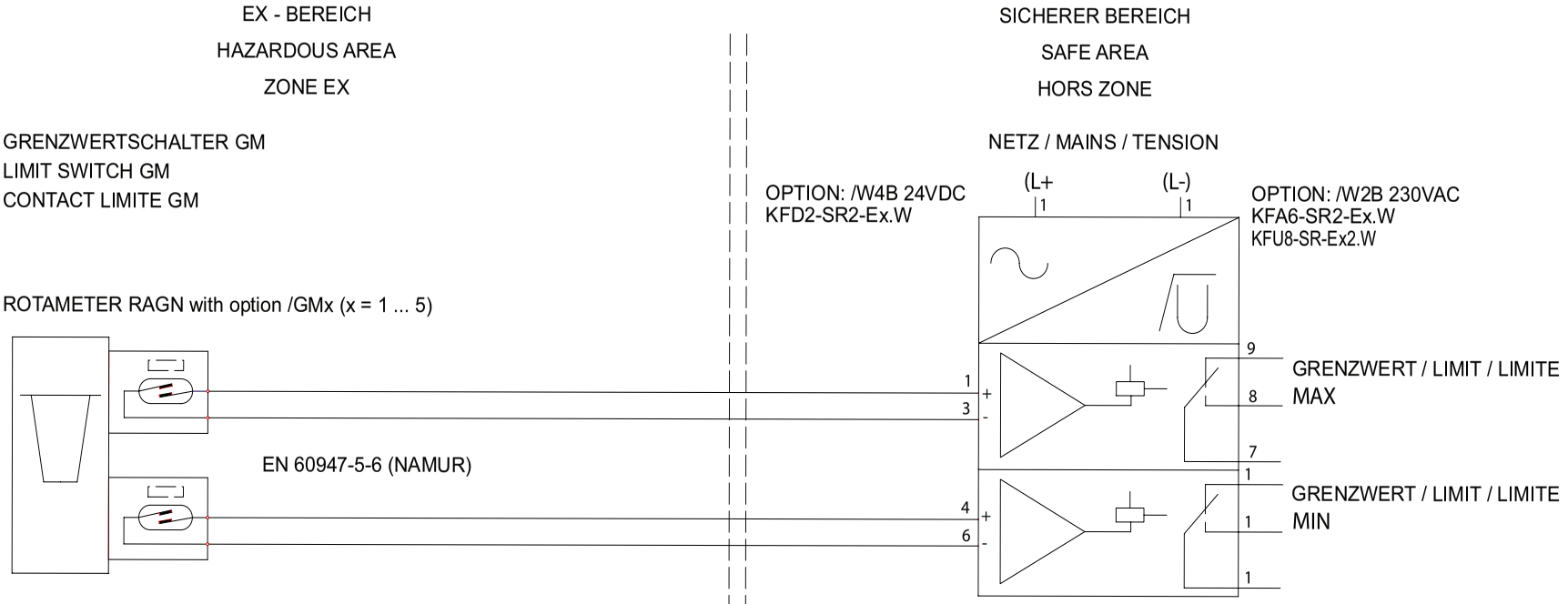
WARNING

- Only trained persons may use the instrument in the industrial area.
- It is forbidden to users to carry out specification changes and other changes at the device. Repairs at the device aren't permitted.
- To ensure explosion protection of the GM, a suitable explosion-proof transformer isolated barrier must be used.
- The maximum ambient temperature and the maximum temperature of the medium, which flows through the tube, may not exceed 70 °C.
- The connection cable may not be exposed to mechanical loads. The maximum axial strength is 30 N.
- Static charge of the GM case has to be avoided. A corresponding warning note has to be attached at the device.

The limit switch GM is classified according EN 60079-11 chapter 5.7, IEC 60079-11 chapter 5.7 and ANSI/ ISA 60079-11 chapter 5.7 as "Simple Apparatus".
For use in hazardous area the limit switch must be connected to a suitable explosion-proof transformer isolated barrier, which does not exceed the following maximum values:

Maximum voltage Uo : 15 V
Maximum current Io : 50 mA
Maximum power Po : 187 mW
Classification :

- Type : GM1 or GM2
- Protection : intrinsic safe
- ATEX / IECEx : IIC 2G
- FM : I, 1, A, B, C, D
- Temperature class : T6
- Entity parameters : Ui = 15 V ; Ii = 50 mA ; Pi = 187 mW ; Li ≈ 0 mH ; Ci ≈ 0 nF



MAXIMALE MEDIUMS UND UMGEBUNGSTEMPERATUR
MAXIMUM MEDIUM AND AMBIENT TEMPERATURE
TEMPERATURE AMBIANTE ET TEMPERATURE DE FLUIDE MAXIMALE
T_{amax} = 70°C

GM1, GM2
Ex IIC T6
U_{max} = 15V
I_{max} = 50mA
P_{max} = 187mW
C = 0nF
L = 0mH
T_{amax} = 70°C

KFD2-SR2-Ex2.W
[Ex ia] IIC
U_o = 10,5V
I_o = 13mA
P_o = 34mW
C_o = 2410nF
L_o = 210mH
T_{amax} = 60°C

PTB 00 ATEX 2080

KFA6-SR2-Ex2.W
[Ex ia] IIC
U_o = 10,6V
I_o = 19.1mA
P_o = 51mW
C_o = 2320nF
L_o = 97mH
T_{amax} = 60°C

PTB 00 ATEX 2081

KFU8-SR-Ex2.W
[Ex ia] IIC
U_o = 10,5V
I_o = 13mA
P_o = 34mW
C_o = 2410nF
L_o = 210mH
T_{amax} = 60°C

FIDI 22 ATEX 0029X

ACHTUNG! ATTENTION! ATTENTION!
DIESE KONFIGURATION IST NUR IN ZONE 1 UND 2 EINSETZBAR
THIS CONFIGURATION IS ONLY FOR ZONE 1 AND 2
CETTE CONFIGURATION EST SEULEMENT POUR LES ZONES 1 ET 2

EINKANALIGE VERSTÄRKER .....-SR2-EX1.W ANSCHLUSS WIE GRENZWERT "MAX"
ONE CHANNEL TRANSMITTER .....-SR2-EX1.W CONNECTION LIKE LIMIT "MAX"
UN CANAL AMPLIFICATEUR .....-SR2-EX1.W RACCORD COMME LIMITE "MAX"

6.3 ATEX non-electrical RAGN (/KC1)

6.3.1 Technical data

Thermal data:

Ambient temperature range: -25 °C to 100 °C
Process temperature range: -25 °C to 100 °C

Temperature classification:

Temp. class	Max. Surface temperature	Max. Ambient temperature	Max. Process temperature
T6	T85 °C	+85 °C	+85 °C
T5	T100 °C	+100 °C	+100 °C

Ex- marking:

Deposition no. IBExU 096/24
II2G Ex h IIC T6…T5 Gb
II2D Ex h IIIC T100 °C Db

Detailed information see in the additional User´s Manual IM 01K01X01-00EN-R.

7. Instructions for PED

The meters RAGN04-..., RAGN05-... and RAGN06-... are produced according the determinations of directive 2014/68/EU (directive for Pressure – Equipment / PED).

The units are classified as pipe according item 3, number 1, 3. letter, a) first dash or according diagram 6 after appendix II:

- Classification as pipe
- For Fluid Group 1 (article 9 chapter (2)).
- Medium fluid and gas

The basic safety requests (for design, production and testing) for all units according to category I are generally determined for the requests of category I.

The units, which are not excluded by PED article 3 paragraph 3, are checked by a conformity-valuation-method according appendix III ´module A´.

IMPORTANT

The user is responsible for the use of our flowmeters regarding suitability and use as agreed.

APPENDIX 1. Safety Instrumented Systems Installation

WARNING

The contents of this appendix are cited from exida.com safety manual on the Rotameter RAGN Flowmeter specifically observed for the safety transmitter purpose. When using the RAGN for Safety Instrumented Systems (SIS) application, the instructions and procedures in this section must be strictly followed in order to preserve the meter for that safety level.

A1.1 Scope and Purpose

This document provides an overview of the user responsibilities for installation and operation of the Rota Yokogawa RAGN variable area flow meter, herein referred to as RAGN Glass Rotameter, in order to maintain the designed safety level. Items that will be addressed are proof testing, repair and replacement of the flow meter, reliability data, lifetime, environmental and application limits, and parameter settings.

A1.2 Using RAGN for a SIS Application

A1.2.1 Safety Function

Suitable for use in Safety Instrumented Systems are the versions listed in table 1 only. The safety related data listed in this manual does not apply to other versions of RAGN.
Table 1 Versions of RAGN suitable for Safety Instrumented Systems

[V1]	RAGN with Reed-switch(es)
[V2]	RAGN with Ring Initiator, fail-safe state: LOW
[V3]	RAGN with Ring Initiator, fail-safe state: HIGH

This variable area flow meter is intended for use as a volume flow monitoring component in a Safety Instrumented System. It has either inductive ring sensors [V2], [V3] or magnetic reed contacts [V1] to indicate limits. The flow meter may be used with the limit switches to feed signals to a logic solver that is part of the safety instrumented function (SIF) as shown in Figure 1. The fault annunciation mechanism is a trip of one of the limit switches. In order to take credit for the automatic diagnostics in the flow meter, this annunciation mechanism must be connected.
Any valve delivered together with RAGN Glass Rotameter is not covered by the assessment.

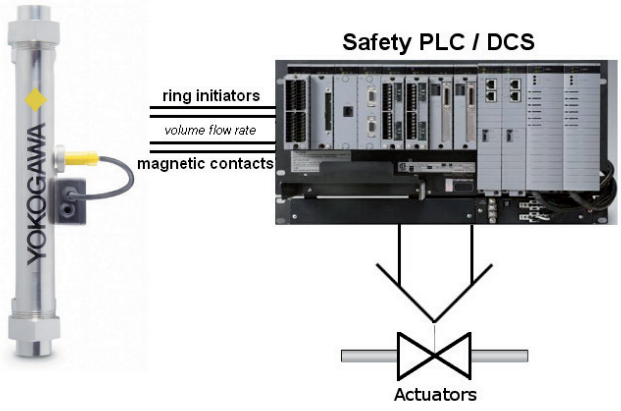


Figure 1 Example Safety Instrumented Function

A1.2.2 Diagnostic Response Time

There is neither diagnostic in the magnetic reed contacts [V1] nor in the inductive ring sensors [V2], [V3].

A1.2.3 Setup

A setup of the flow meter is not required. Installation shall be done according to the manual.
Precautions for use of ring sensors [V2], [V3] in Safety Instrumented Functions:
The high output current should be used as the preferred “safe state”. Therefore to achieve highest reliability of the system, the orientation of the ring sensors should be set according to the application to set high current as safe state. For more information on assembly see User’s Manual, Model RAGN Glass Rotameter, IM 01R01B10-00E-E.

A1.2.4 Proof Testing

The objective of proof testing is to detect failures within the flow meter. Of main concern are undetected failures that prevent the safety instrumented function from performing its intended function.
The frequency of the proof tests (or the proof test interval) is to be determined in the reliability calculations for the safety instrumented functions for which the flow meter is applied. The actual proof tests must be performed more frequently or as frequently as specified in the calculation in order to maintain required safety integrity of the safety instrumented function.
The following tests need to be specifically executed when a proof test is performed. The results of the proof test need to be documented and this documentation should be part of a plant safety management system. Failures that are detected should be reported to Yokogawa.

Proof test for RAGN Glass Rotameter with magnetic contacts and inductive ring sensors:

Step	Action
1	Take appropriate action to avoid a false trip
2	Inspect the device for any visible damage, corrosion or contamination.
3a	Force the RAGN Glass Rotameter to reach a defined “MAX” threshold value and verify that the magnetic contact or inductive ring initiator goes into the safe state. Note: only applicable if RAGN is equipped with a “MAX” contact.
3b	Force the RAGN Glass Rotameter to reach a defined “MIN” threshold value and verify that the magnetic contact or inductive ring initiator goes into the safe state. Note: only applicable if RAGN is equipped with a “MIN” contact.
4	Restore the loop to full operation
5	Restore normal operation

When all the tests listed above are executed a proof test coverage of approximately 99% of possible DU failures in the RAGN Glass Rotameter can be claimed.
The following tools need to be available to perform proof testing:
Measurement instrument to verify output status of the magnetic reed contacts [V1] or inductive ring sensors [V2], [V3]

The person(s) performing the proof test of the Yokogawa RAGN Glass Rotameter should be trained in SIS operations including bypass procedures, flow meter maintenance and company management of change procedures.

A1.2.5 Repair and replacement

Maintenance information can be found in section Service of the User’s Manual, Model RAGN Glass Rotameter, IM 01R01B10-00E-E.
If repair is to be performed with the process online the Rota Yokogawa RAGN Glass Rotameter will need to be bypassed during the repair. The user should setup appropriate bypass procedures for that.
Contact the Yokogawa sales office if this instrument requires repair
The person(s) performing the repair and / or replacement of the Rota Yokogawa RAGN Glass Rotameter should have a sufficient skill level.

A1.2.6 Startup Time

The flow meter will generate a valid signal within 0.5 seconds of power-on startup.

A1.2.7 Reliability data

A detailed Failure Mode, Effects, and Diagnostics Analysis (FMEDA) report is available from Rota Yokogawa with all failure rates and failure modes. Rota Yokogawa RAGN Glass Rotameter is intended for use in a Low Demand Mode. Low Demand Mode means the average interval between dangerous conditions occurs infrequently.

The Rota Yokogawa RAGN Glass Rotameter is suitable for application in SIL1 safety functions for use in a simplex (1oo1) configuration, depending on the PFDAVG calculation of the entire Safety Instrumented Function.

A1.2.8 Lifetime limits

The expected lifetime of the Yokogawa Rota Yokogawa RAGN Glass Rotameter is 10 years. The reliability data listed in A1.2.7 is only valid for this period. The failure rates of the Rota Yokogawa RAGN Glass Rotameter may increase sometime after this period. Reliability calculations based on the data listed in A1.2.7 for Rota Yokogawa RAGN Glass Rotameter lifetimes beyond 10 years may yield results that are too optimistic, i.e. the calculated Safety Integrity Level will not be achieved.

A1.2.9 Environmental limits

The environmental limits of Rota Yokogawa RAGN variable area flow meter are specified in the User's Manual, Model RAGN Glass Rotameter, IM 01R01B10-00E-E.

A1.2.10 Application limits

The application limits of the Rota Yokogawa RAGN variable area flow meter are specified in the User's Manual, Model RAGN Glass Rotameter, IM 01R01B10-00E-E. If the flow meter is used outside of the application limits the reliability data listed in A1.2.7 becomes invalid.

A1.3 Definitions and Abbreviations

A1.3.1 Definitions

Safety	Freedom from unacceptable risk of harm
Functional Safety	The ability of a system to carry out the actions necessary to achieve or to maintain a defined safe state for the equipment / machinery / plant / apparatus under control of the system.
Basic Safety	The equipment must be designed and manufactured such that it protects against risk of damage to persons by electrical shock and other hazards and against resulting fire and explosion. The protection must be effective under all conditions of the nominal operation and under single fault condition.
Verification	The demonstration for each phase of the life-cycle that the (output) deliverables of the phase meet the objectives and requirements specified by the inputs to the phase. The verification is usually executed by analysis and / or testing.
Validation	The demonstration that the safety-related system(s) or the combination of safety-related system(s) and external risk reduction facilities meet, in all respects, the Safety Requirements Specification. The validation is usually executed by testing
Safety Assessment	The investigation to arrive at a judgment - based on evidence - of the safety achieved by safety-related systems

Further definitions of terms used for safety techniques and measures and the description of safety related systems are given in IEC 61508-4.

A1.3.2 Abbreviations

FMEDA	Failure Mode, Effects and Diagnostic Analysis
SIF	Safety Instrumented Function
SIL	Safety Integrity Level
SIS	Safety Instrumented System
SLC	Safety Lifecycle

A1.4 Assessment results

A1.4.1 Safety related parameters

The following results have been obtained from the assessment report Report No.: ROTA YOKOGAWA 11/04-36 R004 Version V1, Revision R1; November 2011 issued by exida.

Average PFD values have been calculated assuming a Diagnostic Coverage (DC) of 99%, a mission time of 10 years and a Mean Time to Restoration of 24 hours.

Table 2: Summary for RAGN – Failure rates

	exida Profile 2		
Version	[V1] Reed contacts	[V2] Fail-safe state LOW	[V3] Fail-safe state HIGH
Fail Safe Detected (λSD)	0 FIT	0 FIT	0 FIT
Fail Safe Undetected (λSU)	20 FIT	2 FIT	11 FIT
Fail Dangerous Detected (λDD)	0 FIT	11 FIT	11 FIT
Fail Dangerous Undetected (λDU)	87 FIT	139 FIT	130 FIT
SFF [3]	18%	8%	14%
MTBF	1035 years	738 years	738 years
SIL AC [4]	SIL1	SIL1	SIL1

Safety metrics according to ISO 13849-1:

MTTFd (years)	1312	761	809
DC [5]	0%	7%	8%
Category (CAT)	CAT 1	CAT 1	CAT 1
Performance Level (required)	PLr = c	PLr = c	PLr = c
Performance Level (calculated)	8.70E-08 1/h	1.50E-07 1/h	1.41E-07 1/h
PFDAVG, T[Proof] = 1 year	4.12E-04	6.61E-04	6.18E-04
PFDAVG, T[Proof] = 5 years	1.91E-03	3.06E-03	2.86E-03
PFDAVG, T[Proof] = 10 years	3.78E-03	6.07E-03	5.67E-03

[3] The complete sensor subsystem will need to be evaluated to determine the overall Safe Failure Fraction. The number listed is for reference only.

[4] SIL AC (architectural constraints) means that the calculated values are within the range for hardware architectural constraints for the corresponding SIL but does not imply all related IEC 61508 requirements are fulfilled.

[5] The switching contact output of [V2], [V3] is connected to a fail-safe NAMUR amplifier. The failure rates of the amplifier are not included in the listed failure rates

Manufacturer:

Rota Yokogawa GmbH & Co. KG
Rheinstr. 8
D-79664 Wehr
Germany

For the actual manufacturing location of your device refer to the model code and/or serial number.

IM 01R01B10-00E-E 5th edition: July 01, 2024-00
Subject to change without notice